verging on the centre, will become visible, and, as the circles narrow, the waves get higher and more conspicuous until the centre is reached again. So the earthquake waves may become too small to be registered as they spread out from the origin, but again affect a seismograph as they converge towards its antipodes. Doubtless it is not only the earthquakes of the newly discovered region in which this takes place, but the present distribution of teleseismographs is not such as will allow of its being established in the case of other earthquake regions.

Apart from these results, which seem well established, there are many suggestions contained in the paper, two at least being important ones. The first of these concerns a peculiarity in the distribution of the stations at which earthquakes are recorded; for instance, those originating in the region to the south-west of New Zealand will be recorded along a band, of about 20° in width, starting in a north-westerly direction, but not at stations lying, nearer the origin, on one side or other of this band. So, too, earthquakes originating off the west coast of South America have been recorded in western Europe and, near their antipodes, in Siberia, but not at stations which we should expect them to affect were they propagated with equal intensity in an opposite direction.

The other suggestion, which may prove of great importance, concerns the diurnal east and west movement of the horizontal pendulum. This only affects pendula which point north and south and swing east and west; it is only noticeable on days when the sun shines, and has been attributed to the action of the sun's rays in heating or drying up the ground on either side of the recording station. These explanations have not proved satisfactory, and it is now suggested that the movement may be due to some other indirect effect of the sun, probably of an electrical nature. The Milne pendulum, with its silk fibre suspension and agate cup bearing, is practically insulated, and Prof. Milne finds that one of his pendula, after being electrically connected to earth, and therefore preserved at the same potential as the outer case and walls of the observatory, does not show the extensive movements it did prior to being earthed. This line of research is being carried forward with the cooperation of Dr. C. G. Knott, of Edinburgh, and we look forward to seeing some interesting results in due course.

We have indicated the most interesting of the results which have come from the seismographic records of the Antarctic Expedition; want of space forbids us to detail the many other suggestions and possibilities set forth by Prof. Milne, but what has been noticed is enough to show the good use that has been made of the record which, taken by itself, has little value, and only becomes important when correlated with those of the thirty-eight other stations where the Milne type of instrument is now installed.

TECHNICAL EDUCATION FOR FISHERMEN.

ABOUT six years ago the Lancashire Sea Fisheries Committee instituted practical classes for the instruction of local fishermen in the natural history of the common marine edible animals. "Technical education" in the strict sense of the word was not the object aimed at. For some time previously the committee had experienced considerable difficulty in enforcing the restrictions on methods of fishing contained in their by-laws on account of the determined opposition of the fishermen, and the object of the classes was rather to remove this opposition by showing the *rationale* of the by-laws, and to create a common ground on which both officers and fishermen could meet. The committee had no funds which they could apply to this work, and the classes were only made possible by the cooperation of the Technical Instruction Committee of the Lancashire County Council, which made an annual grant of 250*l.* to be spent for this purpose.

Practically all this money is expended in providing "fisheries exhibitions" of the value of 5*l.* each. One or more of these is allotted to each fishing centre in the administrative county of Lancaster, and the men selected to attend are chosen in various ways. In some cases they are selected by the fishermen's associations, and in other cases they are chosen by the officers of the committee. The grant of 5*l.* is intended to recompense the fisherman exhibitioner for the loss of his labour during the time he attends the class, and to provide for his expenses during this period.

The first two experimental classes were held at the (then) University College of Liverpool, but subsequently the work was transferred to the Lancashire Fishery Station at Piel, in the Barrow Channel, where tanks and other apparatus for the study of living organisms are provided by the fisheries committee, and where living material can easily be landed by the committee's vessels. The men are brought to Piel and taken away again by the patrol steamer, and lodge in the neighbourhood of the station. Each class consists of fifteen men, the maximum number which can be taught at one time with advantage. Twenty two-hour lessons are given during each course.

The course of instruction was drawn up by Prof. Herdman and Mr. Johnstone, and great care was taken to arrange a logical sequence of lessons. The structure of a typical fish is the first lesson, and this is followed by an account of the life-history of a typical mollusc such as the mussel. A short demonstration of the main chemical and physical processes involved in the respiration of marine animals is then given, and the manner of feeding of two such divergent types as the fish and mussel is then considered, a discussion which naturally leads up to three or more lessons on the nature and occurrence of plankton and on the economic importance of the latter. The remaining lessons deal with the life-histories of other economic marine animals, the cockle and oyster among Mollusca, and the shrimp and crab among the Crustacea. The life-histories of various fishes, such as the flat-fish and skate, are also considered, and the development of the flounder is studied from the process of fertilisation up to the time when the embryo issues from the egg. Although lantern and other demonstrations are given, the instruction is in the main practical in character, each man being provided with a good microscope and a set of dissecting tools.

On the whole the results of the classes have been very satisfactory; the main object, that of bringing about a better understanding between the fishermen and the committee, has been attained, and though there is still considerable opposition on the part of the fishermen towards the by-laws, yet the relations are much less embittered than was formerly the case. Another result of considerable importance has been attained in that the shell-fish transplantation operations carried on at Morecambe (an account of which was given recently in NATURE, August 31, p. 430) have been traced directly to the stimulus afforded by the classes. This work was originated by the Morecambe fishermen themselves, and it was in this district that the fishery classes were most appreciated and supported.

J. J.

LIFE-HISTORY OF THE EMPEROR PENGUIN.[1]

THE emperor is the largest of all the penguins, and is limited strictly to the ice-covered regions of the Antarctic. The interest of its life-history lies chiefly in the fact that its breeding ground was first discovered during the recent expedition made by the *Discovery* into the Antarctic. Its young and its eggs were brought home for the first time when the *Discovery* returned to England in September, 1904.

In reviewing the life of this bird, the difficulties of investigating its breeding habits were explained as the result of certain peculiarities; for example, that of laying the eggs in the middle of the winter darkness; each hen laying a single large egg, which it incubates as it stands in an upright position on sea-ice, keeping the egg from contact with the actual ice by holding it on the *dorsum* of the foot, and allowing a heavily feathered fold of skin to fall over it from the abdomen, thus completely obscuring it from view, and keeping it closely appressed to the abdomen, warm enough to hatch out, probably in some seven weeks. In the coldest month of the whole year,

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[1] Abstract of a paper delivered before the Royal Institution by Edward A. Wilson.

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viz. August, the chicken is hatched out, and becomes the unwilling recipient of so much attention from its parents, and from such other adults as have no young of their own to attend to, that upwards of 77 per cent. die, and may be picked up frozen on the sea-ice, within the first month or two of their existence. This high death-rate is in a large measure the result of the quarrels of adult birds for possession of a chicken, all having an overpowering desire to brood over something. In many cases the desire leads to brooding over dead chicks until they are actually rotten.

Much was said of the trials that must be endured by the naturalist who wishes to see this bird in its breeding haunts. He must be ready to encounter the lowest temperatures hitherto recorded, under canvas, sleeping three in a bag for what warmth can be procured at 40°, 50°, and 60° below zero Fahrenheit, and for a fortnight or three weeks at a stretch. Much, also, was said of the various sledge expeditions undertaken, after its first discovery by Engineer-Lieutenant Skelton, R.N., for the purpose of fully investigating the emperor penguin rookery at Cape Crozier; of the discovery of the first egg on the sea-ice by Lance-Corporal Blissett, R.M.L.I., and of the exceptional circumstances which, in the following year, enabled the lecturer to bring back to the ship a series of some fourteen eggs and several dozen of the young.

Examples were shown at the close of the lecture, which was further illustrated by a series of lantern slides, made from photographs taken mainly by Mr. Skelton and from drawings by the lecturer of the various stages in growth of the emperor penguin, from infancy to old age.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IN view of the approaching contest for the representation of the University of London in Parliament, Sir Michael Foster, K.C.B., and Sir Philip Magnus have placed their opinions before members of Convocation of the University.

SIR WILLIAM ANSON has accepted the position of president of the Association of Technical Institutions for next year in succession to Sir Philip Magnus. The annual meeting of the association will be held at the Fishmongers' Hall on January 26 and 27.

THE annual conversazione of the Royal College of Science and Royal School of Mines was held on December 20. All the departments of the college and school were open, and many interesting exhibits were shown in chemistry, physics, mechanics, metallurgy, mining, geology, botany, and zoology, including applied science. The metallurgy section comprised a working exhibition of Japanese smelting methods shown for the first time in Europe. Japanese casting was made during the evening. The programme also included a lecture by Prof. S. H. Cox on "Incidents of a Mining Career."

THE late Mr. John Feeney, by his will dated June 22, 1903, bequeathed sums amounting to 89,000*l.* towards various institutions and objects connected with Birmingham and district. These include 20,000*l.* to the University of Birmingham. This bequest is for the purpose of maintaining a professor, with suitable equipment, lecturing on some one or more scientific subjects directly connected with some one or more of the trades and industries carried on in or near Birmingham. All the bequests are given free of legacy duty, but payment cannot be claimed until the expiration of five years.

THE Board of Education has published the reports, for the year ending March 31, 1905, of fourteen colleges which participated during the year in the annual grant, amounting to 54,000*l.*, made by Parliament for "university colleges in Great Britain," and from the three colleges in Wales which receive a grant of 4000*l.* each. The reports have been compiled, so far as has been found conveniently possible, under the same headings as those adopted in previous years. The distinguishing characteristic of the reports is the elaborate balance sheet with which each is provided showing exactly the revenue available in the case of each college and what precisely is done with it.

A BLUE BOOK (Cd. 2782) has been published giving the statistics of public education in England and Wales for the years 1903–5. The volume of 442 pages is divided into three sections, dealing respectively with elementary schools, State-aided secondary schools, and technical institutions, schools of art and day art classes, evening schools, and similar forms of education. A technical institution within the meaning of the regulations of the Board of Education is an institution giving an organised course of instruction in day classes, including advanced instruction, and provided with a staff and equipment adequate for the purpose. Provision must be made for at least a two years' systematic course in science, or in science and art, either alone or in conjunction with subjects of general, commercial, manual, or technological instruction; and subject to certain temporary provisions, no student may be admitted to the course unless he has passed through, at least, a three years' course of instruction in a school recognised under the regulations of the Board for secondary schools, or unless he is more than sixteen years of age and is qualified from his general education to profit by a course of advanced instruction. These institutions, in fact, afford instruction adapted for the preparation of young men for employment in connection with the trades, manufactures, and commerce of the country. They also provide higher courses of specialised instruction in science in relation to particular industries, likely to be required by students who have already had a good training in pure science. The number of these institutions receiving grants was nineteen in 1903–4. The number of students who attended at all during the year was 2143, and a grant of 5683*l.* was paid on 1056 of these who attended a full course of instruction. In the same year there were 5579 recognised evening schools with 696,882 students in attendance, on whose work a grant of 304,962*l.* was paid.

AT the annual headmasters' conference held at the College of Preceptors, London, on December 21, the subject of the inspection of schools was dealt with very fully, and numerous resolutions were adopted. Dr. Gow, of Westminster, moved a resolution, subsequently carried *nem. con.*, that the conference desires to emphasise the principle that inspection should take into due consideration the aims and circumstances of the school inspected, and regard intellectual methods and results as of greater weight than material equipment and appliances. Dr. Gow is reported by the Press to have said "there is a general opinion on the part of the public, which is shared by many teachers of science, that great expenditure is necessary for effective scientific teaching, and that schools are invited to compete with one another in mere expenditure. This competition is bad for the schools, for the teachers, and for the boys." It may be contended, he continued, that the better the teacher the more apparatus he wants, but Dr. Gow admitted that his own experience is the contrary of this. "No contention can be more absurd," he concluded by saying, "than that science teaching differs from any other because the science teacher does not teach by authority; it is, as a fact, conducted quite as much on authority as classical teaching, or divinity, or any other subject. The experiments are merely illustrations." The headmaster of Westminster has apparently been unfortunate in his experience of science teaching. Every man of science agrees with him that for the effective teaching of the broad principles of science the simplest apparatus, if of the right kind, is sufficient. This competition among schools to provide the most luxurious laboratories and lavishly stocked lecture-rooms, if it exists, is at least a very modern growth, and should, as Dr. Gow maintains, be discouraged. But at the same time a sensibly designed science workshop with simple fittings and an adequate supply of ordinary apparatus is an absolute necessity for every efficient school. It is difficult to understand what Dr. Gow means when he maintains that science teaching is as much based on authority as the teaching of classics or divinity. There is a confusion of thought here. Reasonable science teaching, with which Dr. Gow seems unfamiliar, insists that the pupil shall believe only because experimental results leave no other alternative, and not because a teacher or a text-book makes a statement. If in any school experiments are used only as illustrations the methods of science

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